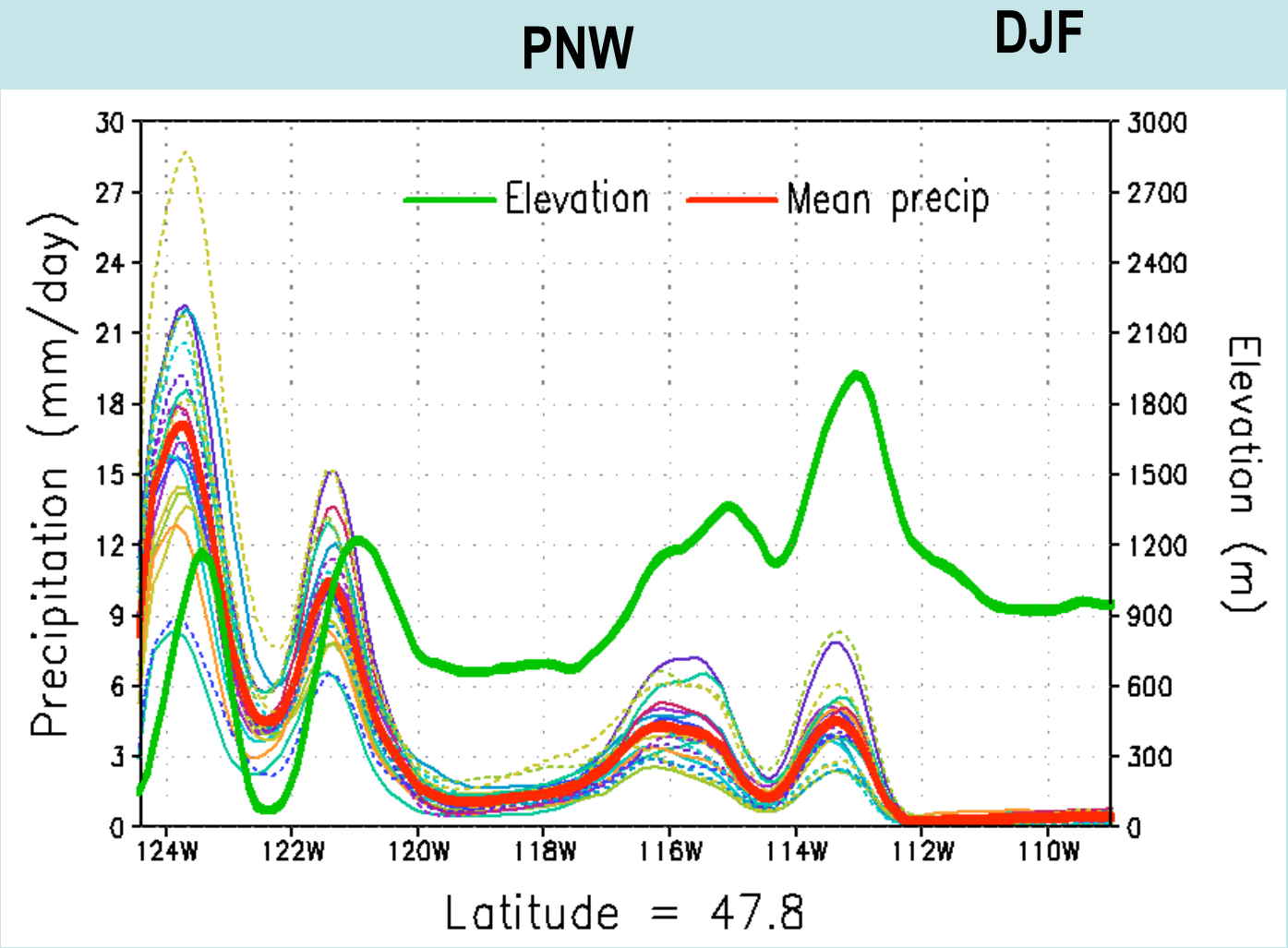
Regional Climate Modeling for the West Coast

L. Ruby Leung
Pacific Northwest National Laboratory

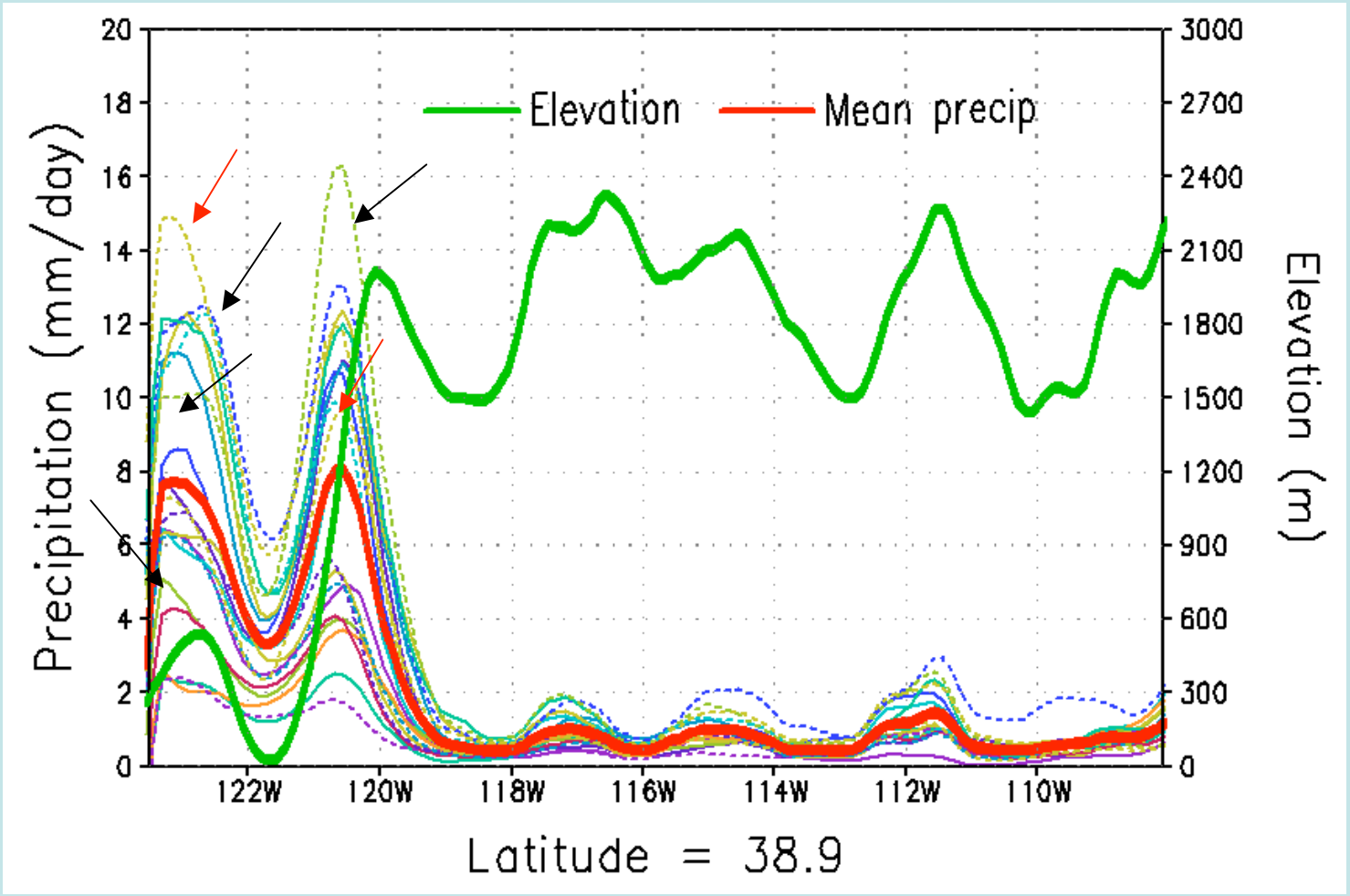
Second Annual Climate Change Research Conference, California Energy Commission
and
First Scientific Conference, West Coast Governors' Global Warming Initiative

Sacramento, CA
September 14-16, 2005

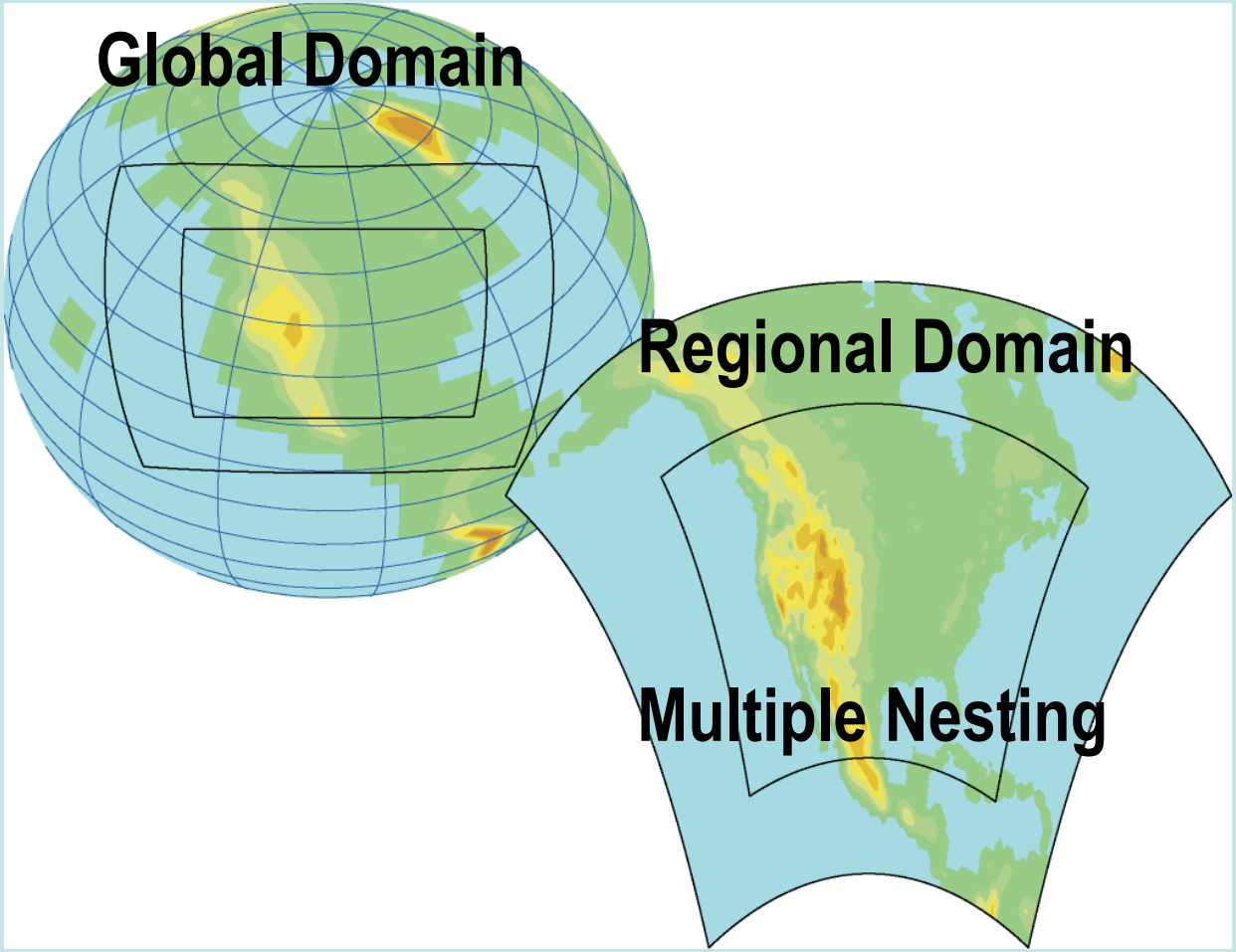
Regional climate is determined by the interaction of forcings and circulations that occur at the planetary, regional, and local spatial scales



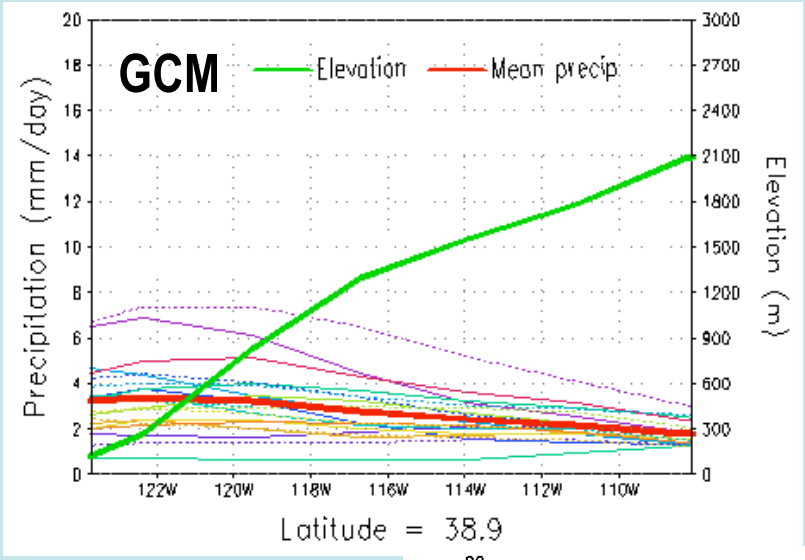
Important aspects of water cycle must be predicted at the regional scale for societal use

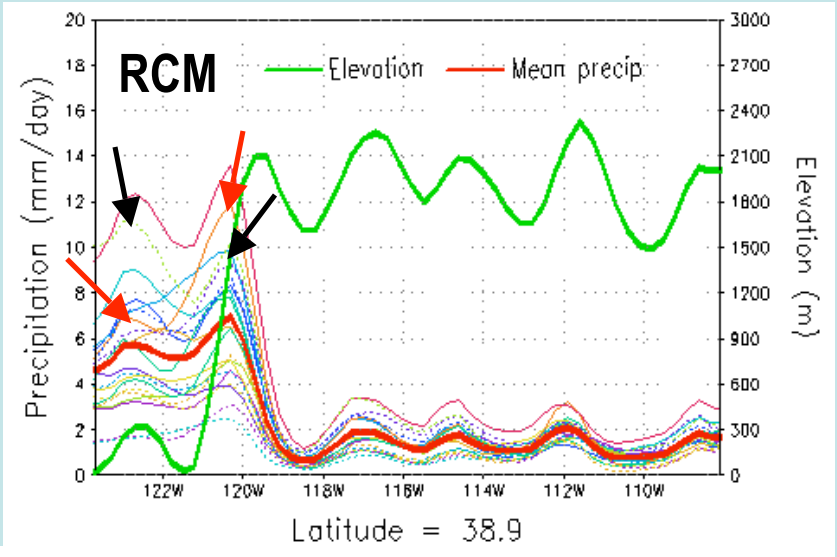


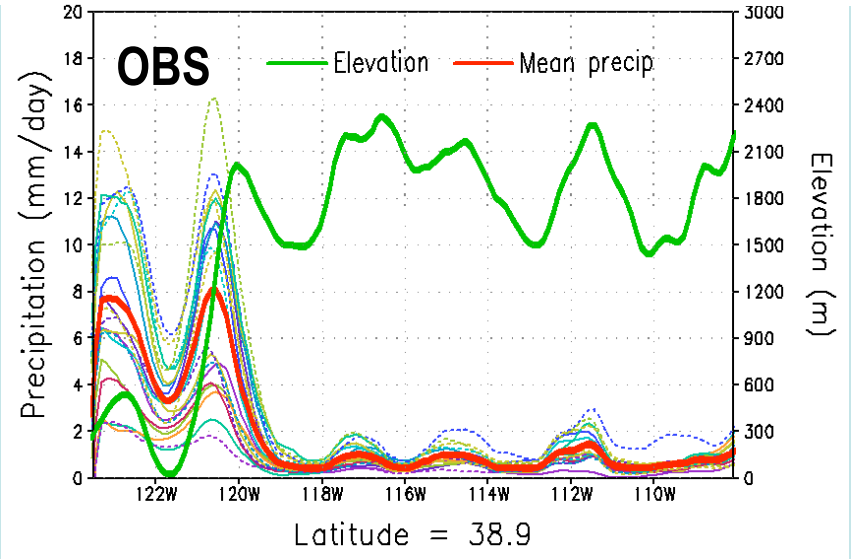
Downscaling by Regional Climate Modeling



Representation of variability in the observation, a GCM, and an RCM in the California transect

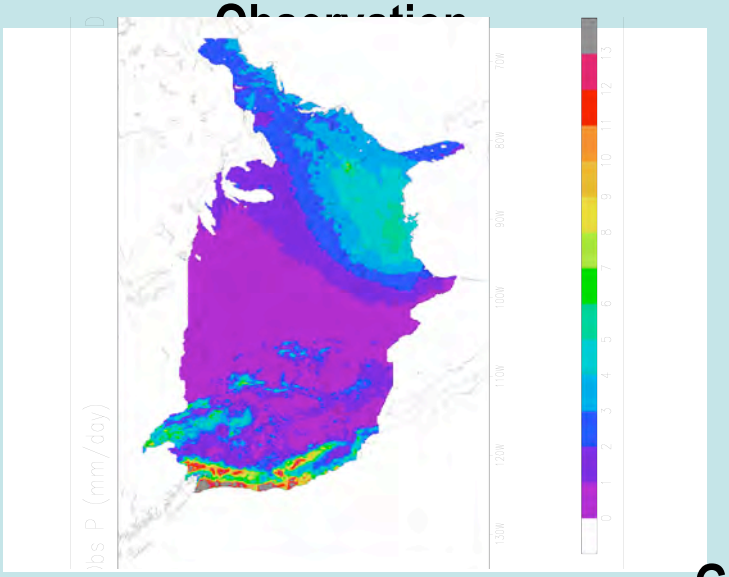




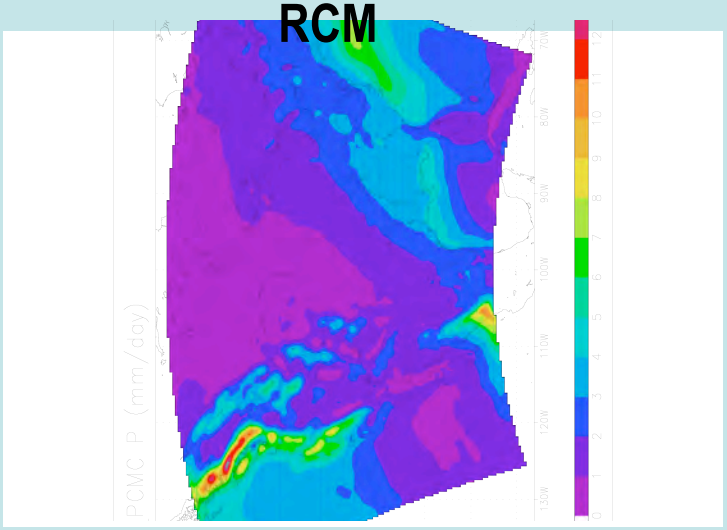


Cold Season Mean Precipitation (DJF)

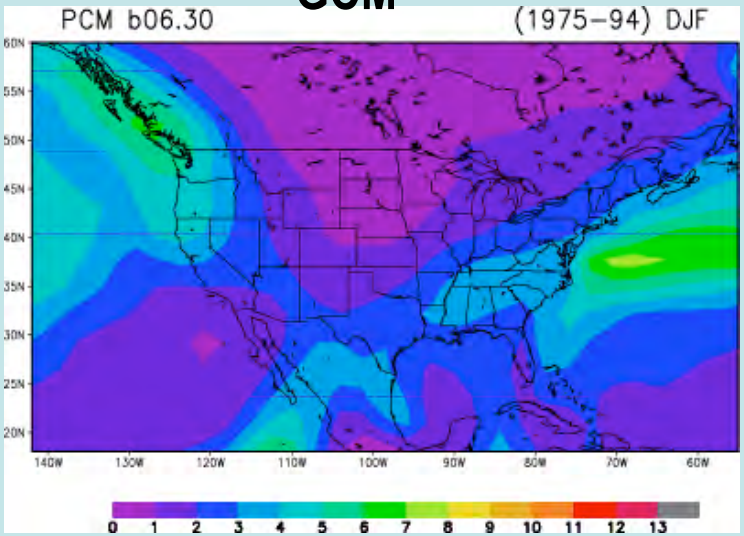
Observation



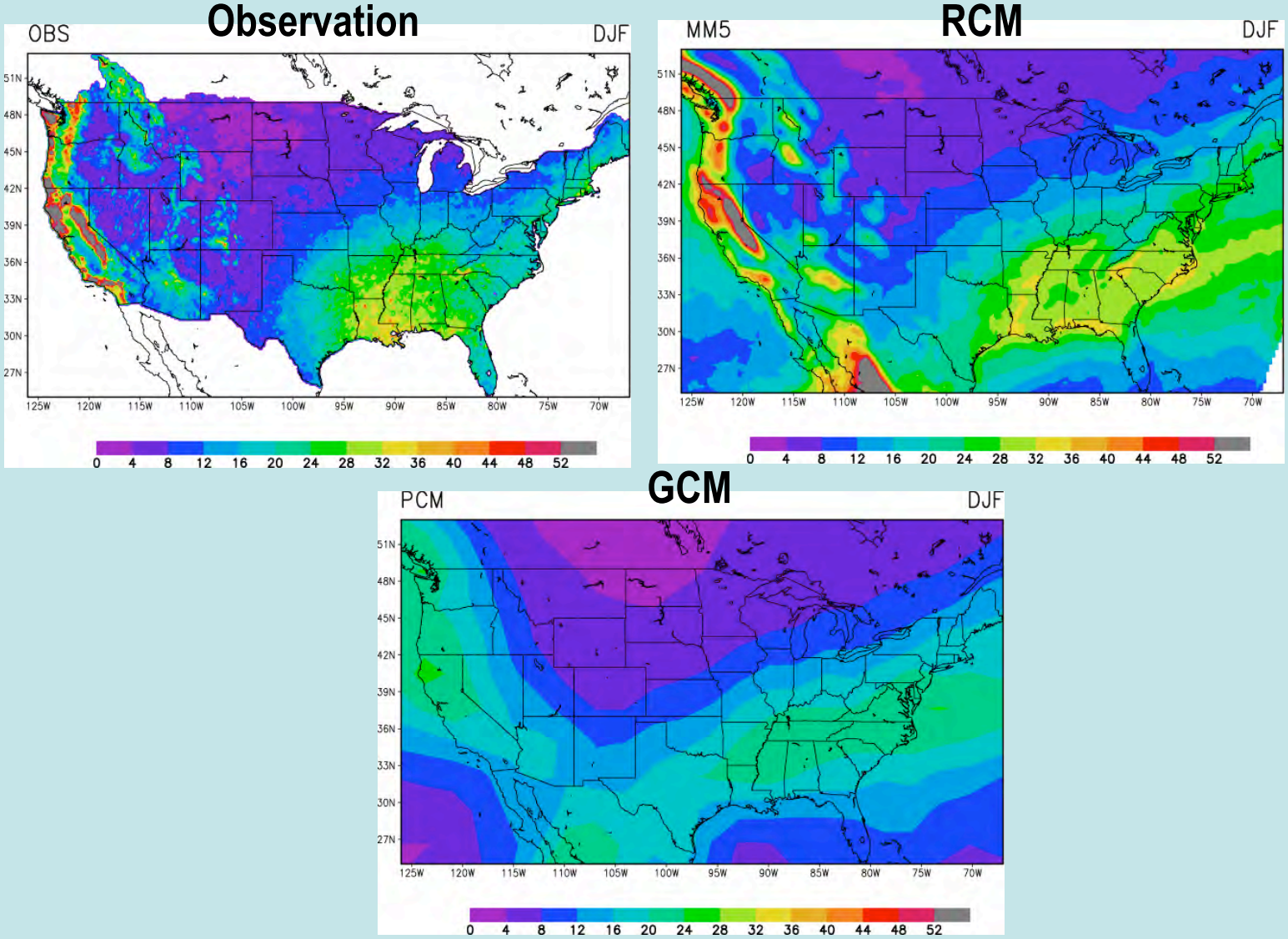
RCM



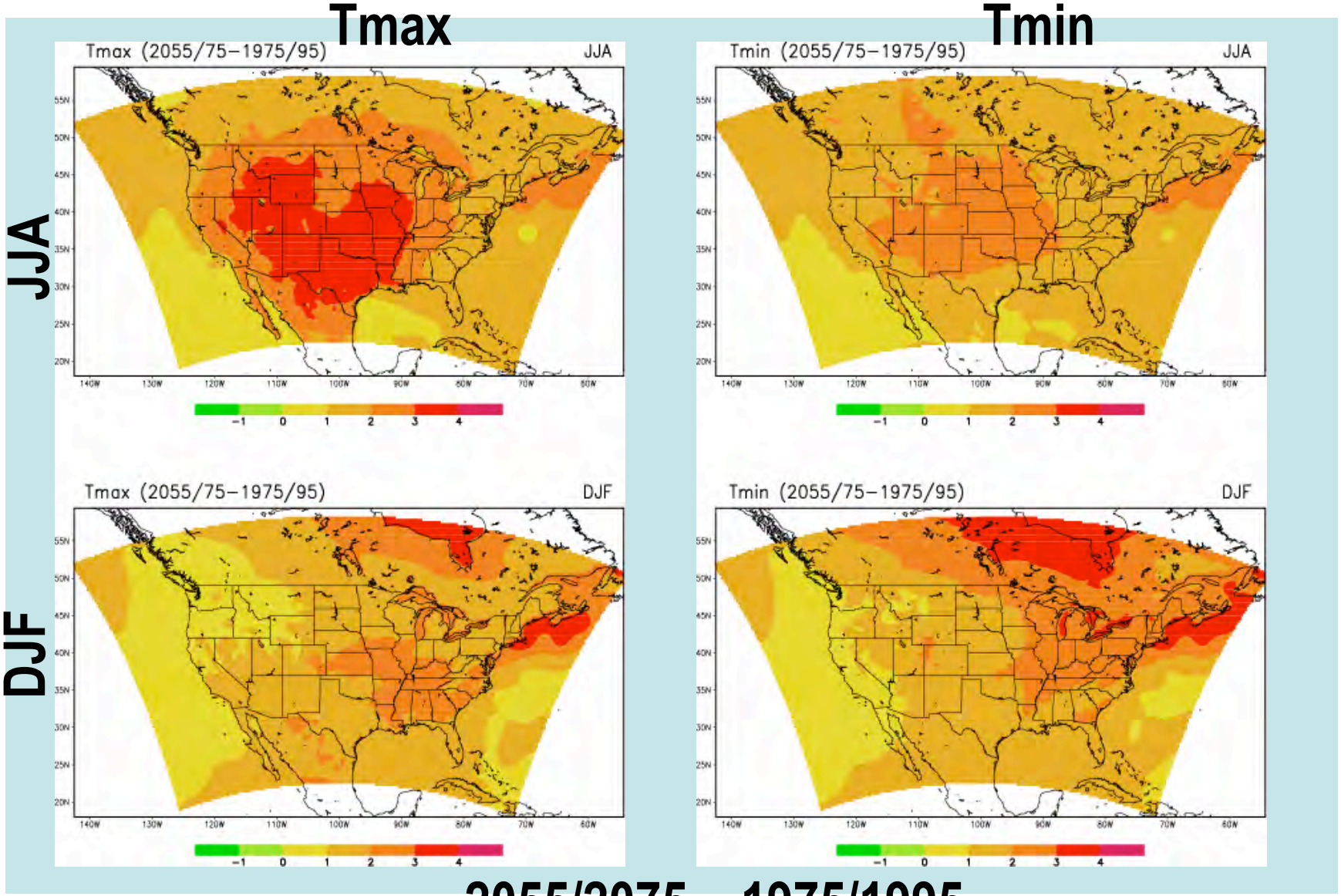
GCM



Extreme Daily Precipitation (DJF)



Change in Daily Max/Min Temperature

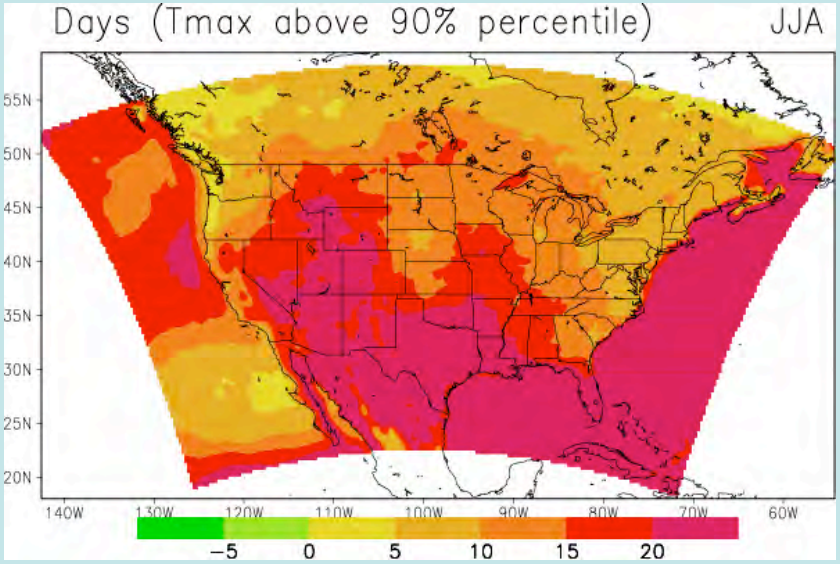


2055/2075 – 1975/1995

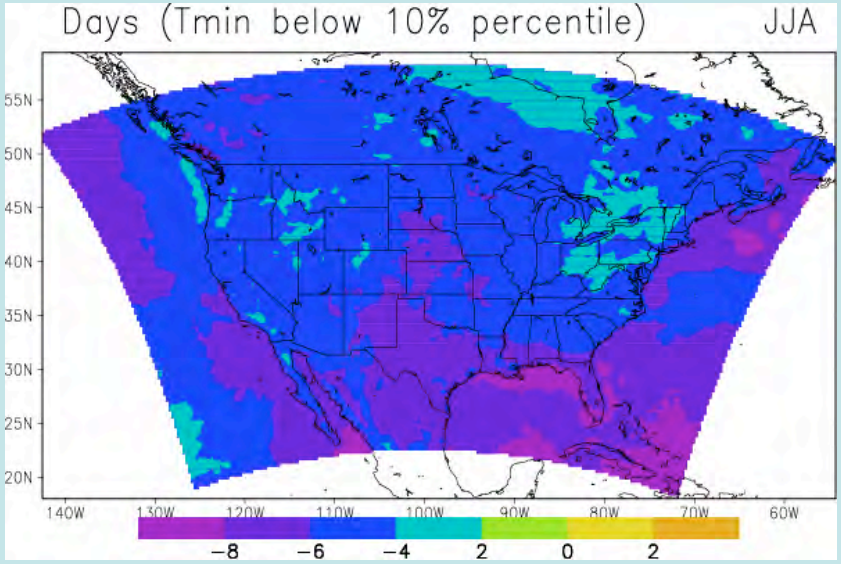
Change in Extreme Summer Temperature

2055/2075 – 1975/1995

#Day Change in Tmax > 90%



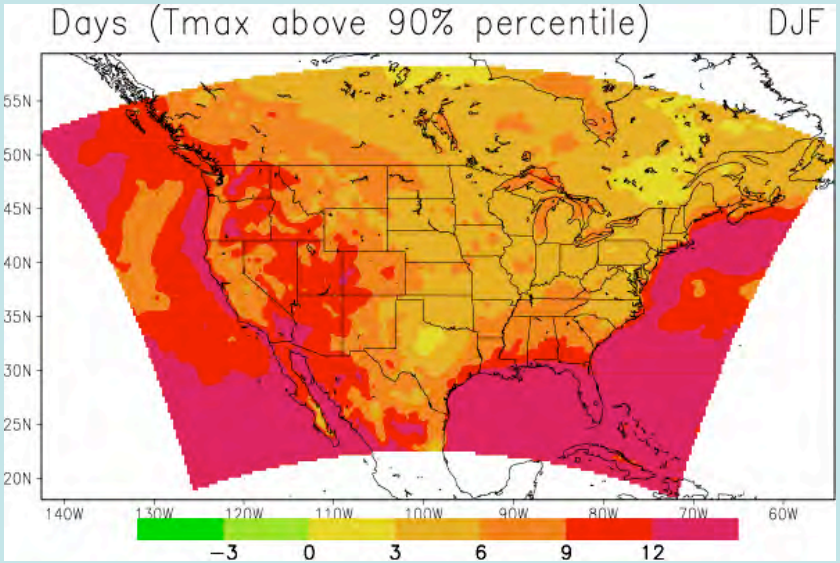
#Day Change in Tmin < 10%



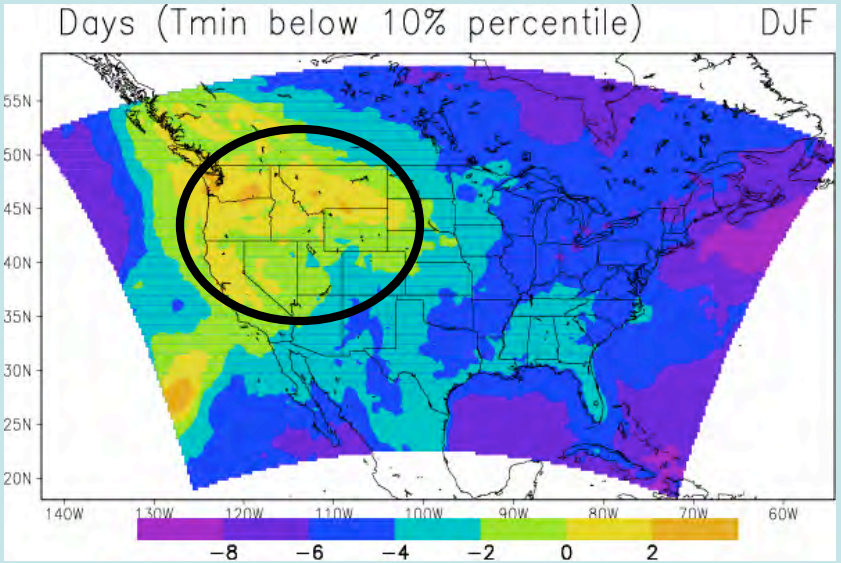
Change in Extreme Winter Temperature

2055/2075 – 1975/1995

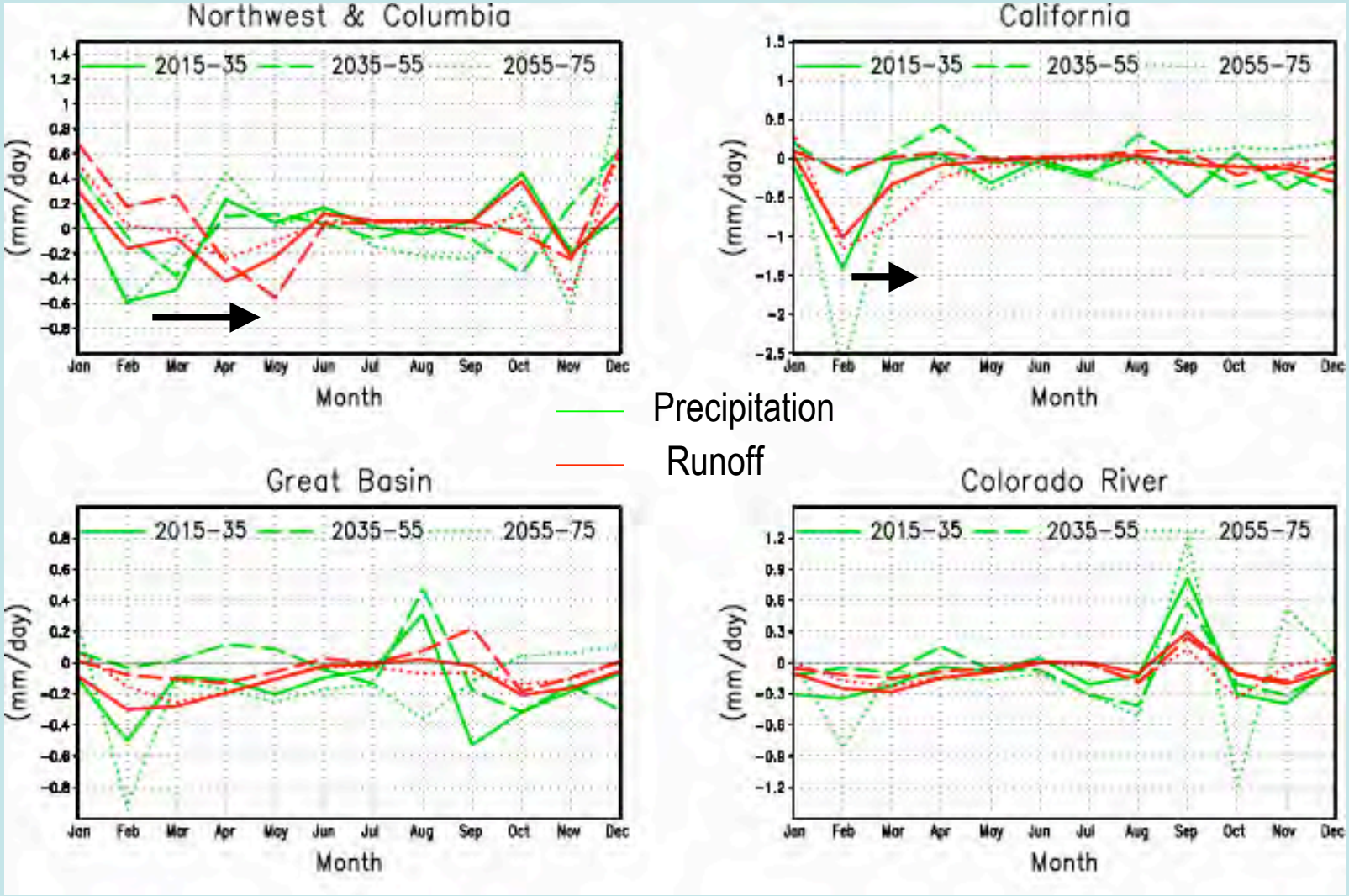
#Day Change in Tmax > 90%



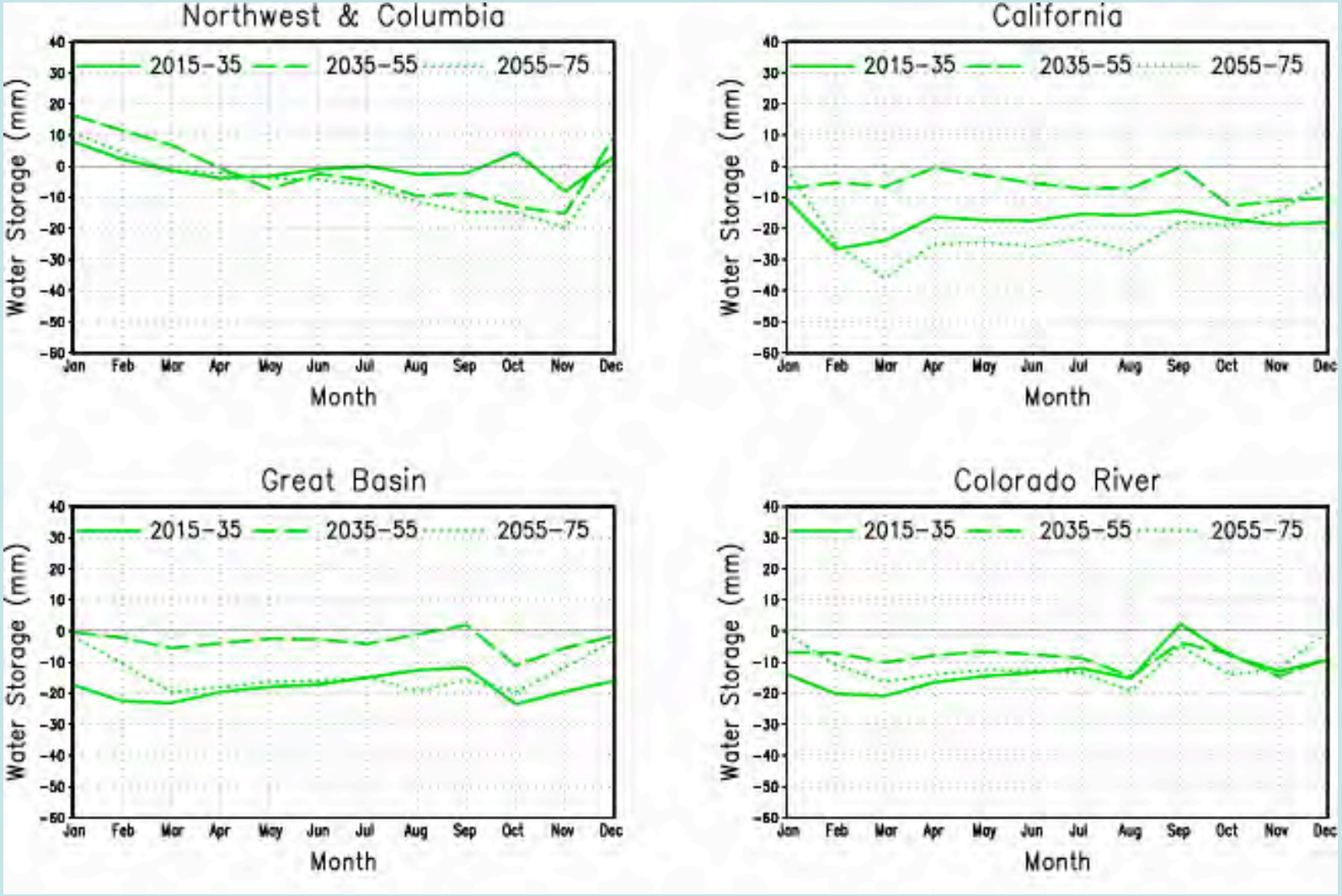
#Day Change in Tmin < 10%



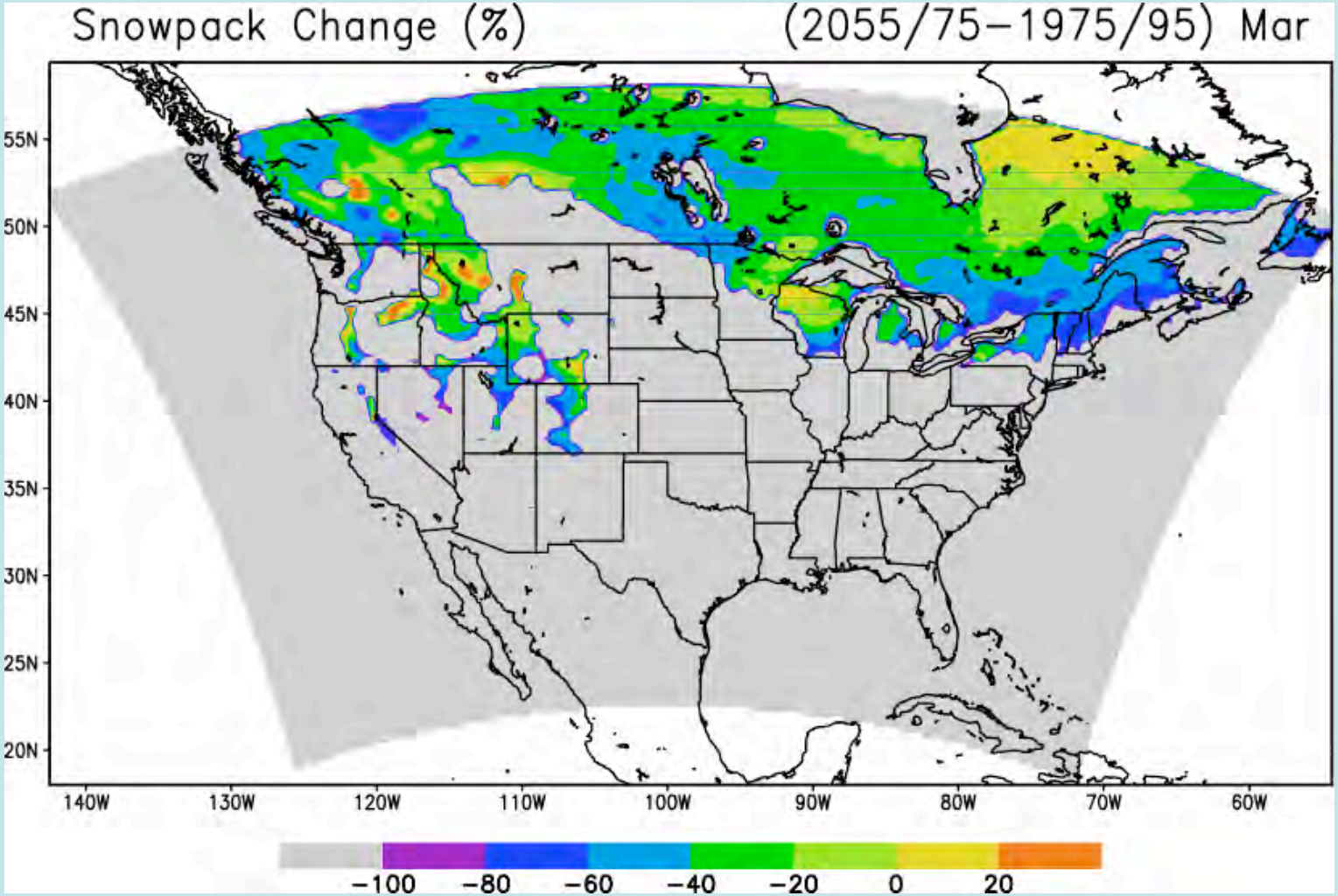
Change in Precipitation/Runoff



Change in Soil Moisture



Change in Snowpack



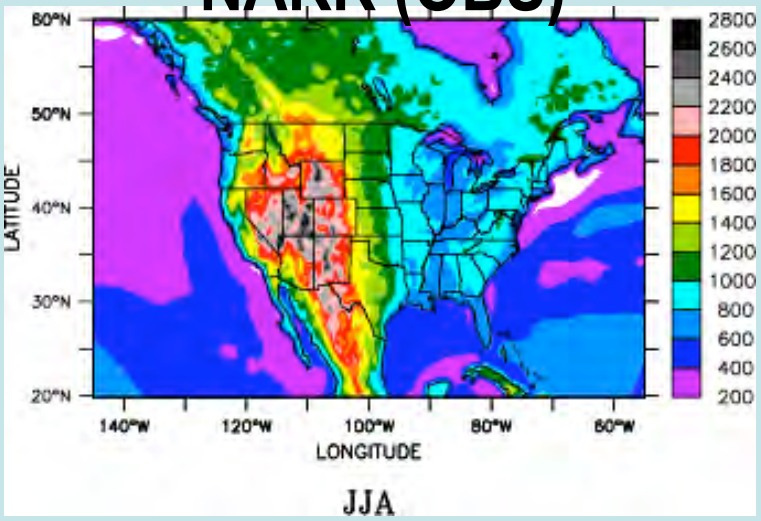
Evaluation of Meteorological Conditions for Air Quality Assessment

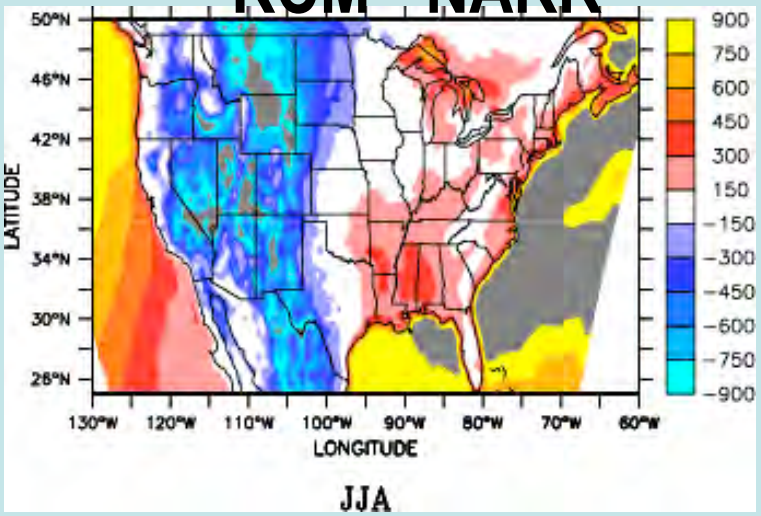
NARR (OBS)

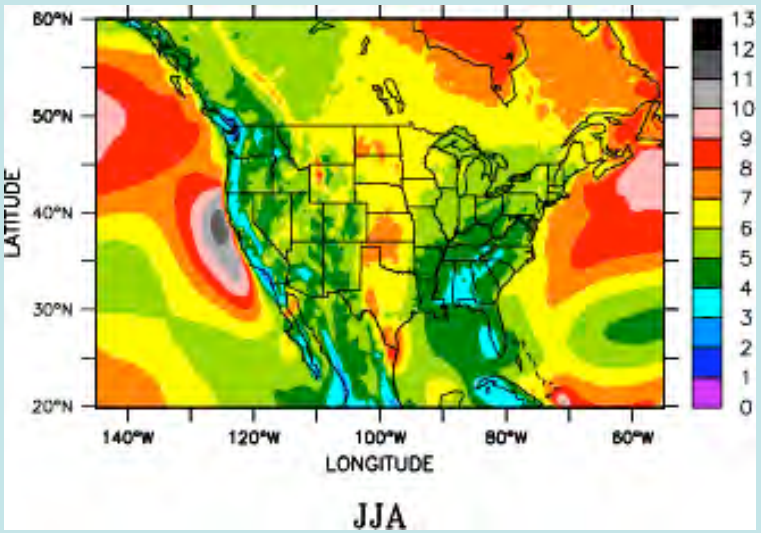
RCM - NARR

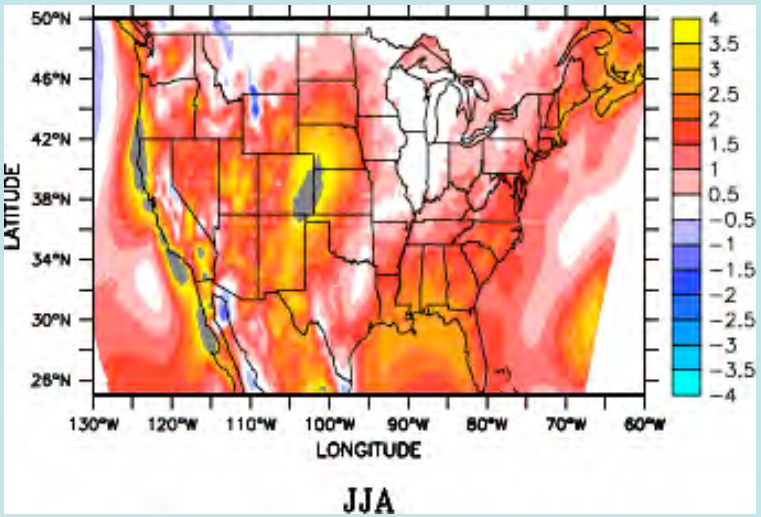
PBL Height (m)

PBL Winds (m/s)



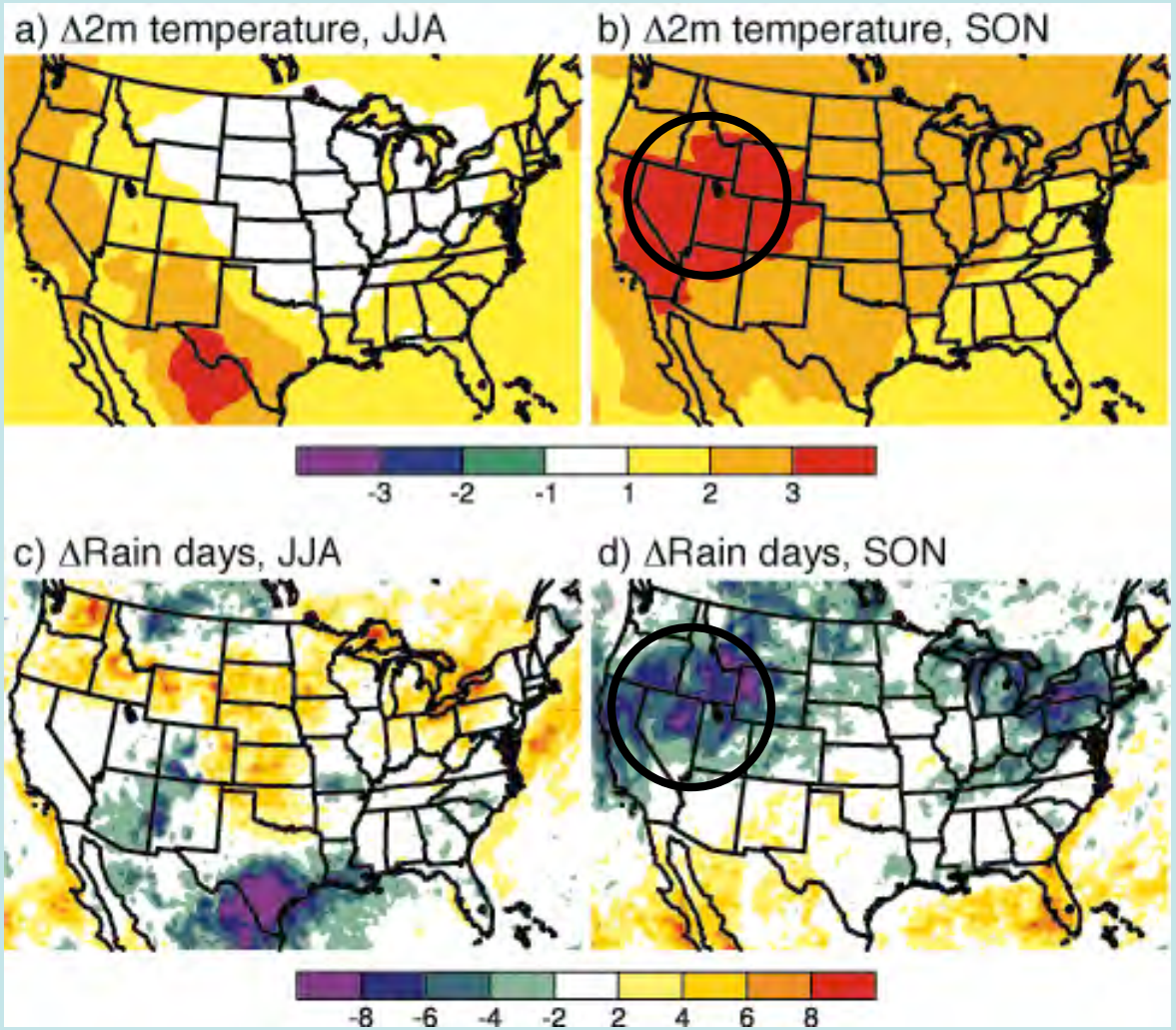






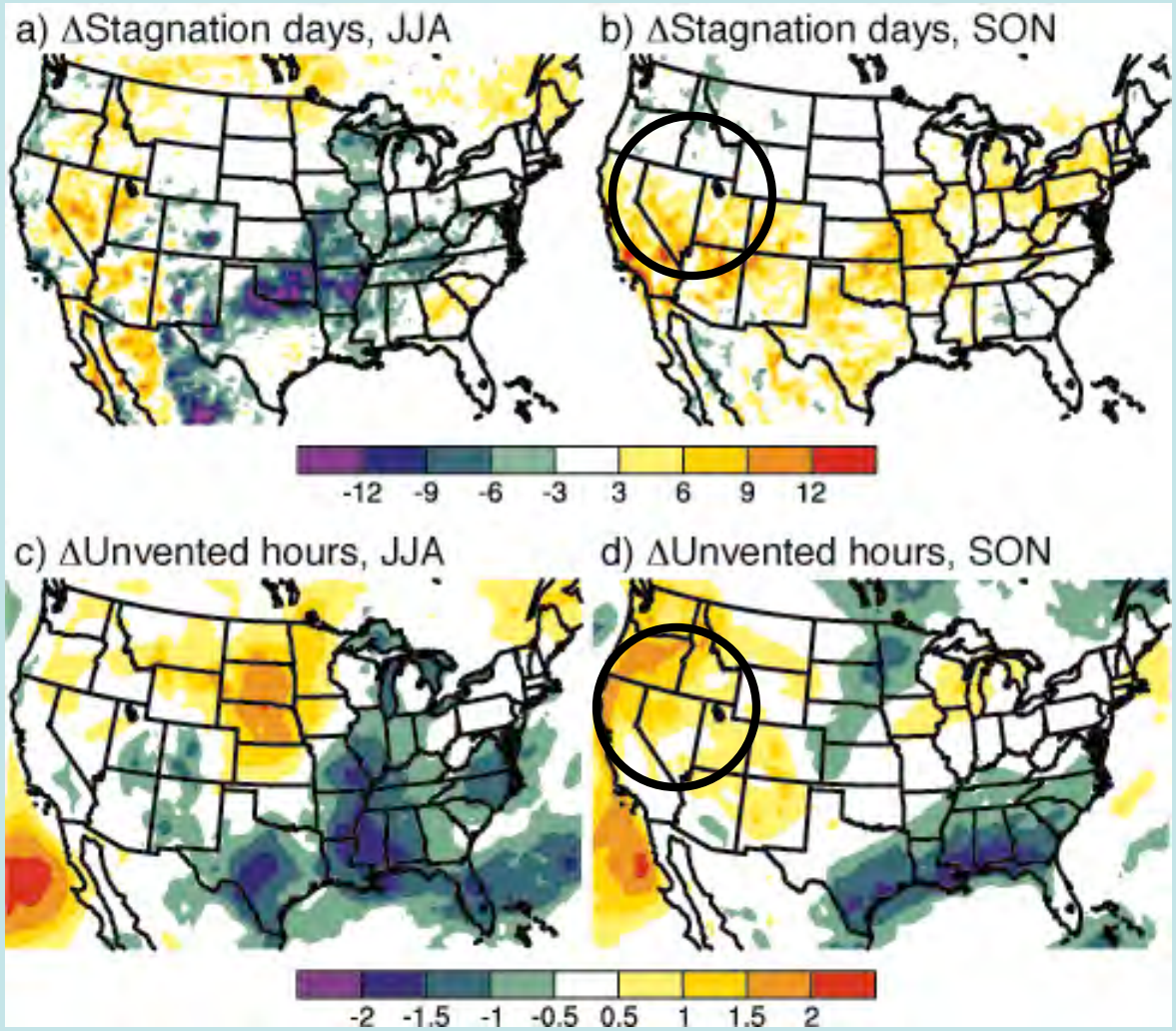
Temperature/Rain Freq Change

Air Quality Assessment



Leung and Gustafson 2005 GRL

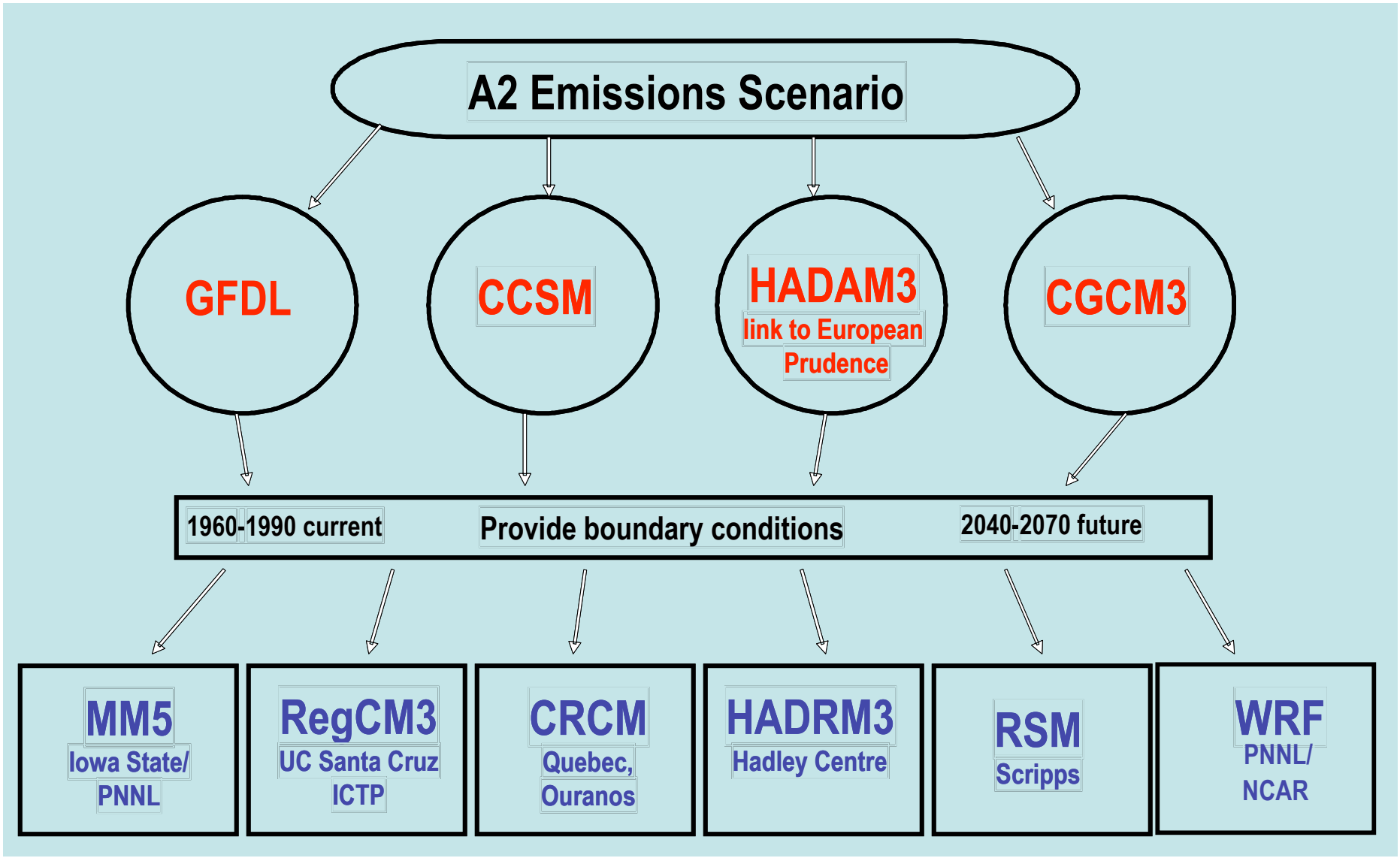
Stagnation/Ventilation Change



Assessing Uncertainty

- PRUDENCE is a European program to assess uncertainty in climate change projections by using multiple GCMs and RCMs
- Main conclusions: (1) seasonal mean changes are largely determined by GCMs; and (2) changes in detailed patterns and extremes are largely determined by RCMs

North American Regional Climate Change Assessment Program (NARCCAP) Plan (PI: Linda Mearns)



Summary of Potential Changes (2050 – 2075)

Changes	PNW	CA
Temperature	2-3^{o}C	2-3^{o}C
Extreme Hot Days	Increase 5-15 days	Increase 10-20 days
Extreme Cold Days	Small increase	Small increase
Precipitation	Drying (Insignificant)	Drying (Insignificant)
Snowpack	-20% to -60%	-40% to -70%
Runoff	Reduced spring runoff	Reduced winter runoff
Soil Moisture	Reduced in summer	Reduced year round
Air Quality	Reduced (reduced ventilation)	Reduced (increased stagnation frequency)